## IHC DIESEL TURBOCHARGING SYSTEM

**IHC**
**Scout II, Terra & Terra Traveler**
**(6-Cylinder Diesel Engine Only)**

### DESCRIPTION

The turbocharger assembly consists of an exhaust driven turbine and a centrifugal air compressor which are mounted on a common shaft. This shaft is supported between the turbine and compressor wheels by a cast center housing. A tightly fitting turbine housing and compressor housing mount to this center housing assembly. A wastegate is mounted directly to the turbine housing to protect engine against over boosting the engine.

The turbine housing mounts directly to the exhaust manifold outlet and the exhaust header pipe mounts to the center of the turbine housing. The compressor housing is connected between the intake manifold and air cleaner assembly with ducting.

### OPERATION

When the engine is running, exhaust gases are directed through the turbine housing and turbine wheel vanes, then into the exhaust header pipe. The exhaust gas pressure and heat energy causes the turbine wheel to rotate, which rotates the compressor wheel. The spinning compressor wheel draws air through the air cleaner into the compressor housing, compresses it and delivers the compressed air to the intake manifold.

The increased density of the air delivered to the engine cylinders allows an increased amount of fuel to be injected while still maintaining the air/fuel ratio for proper combustion. This increase in weight of fuel burned results in an increase in power output.

To control shaft speed and compressor output, a poppet-type wastegate valve is mounted in turbine housing inlet passage. Pressure is sensed at the wastegate valve diaphragm. When pressure reaches a predetermined level, the diaphragm actuates the valve allowing exhaust gas to be by-passed directly into the exhaust system. The valve's position varies with the degree of pressure rather than being an "ON-OFF" valve.

Since the compressor assembly can, during normal operation, reach speeds of 150,000 RPM, shaft lubrication is essential to prevent self destruction of the center housing and rotating assembly (CHRA). The shaft is supported in 2 ball bearings and is pressure lubricated with engine oil. Whenever any kind of engine work that involves disassembly of engine components is performed, engine oil and filter should be changed.

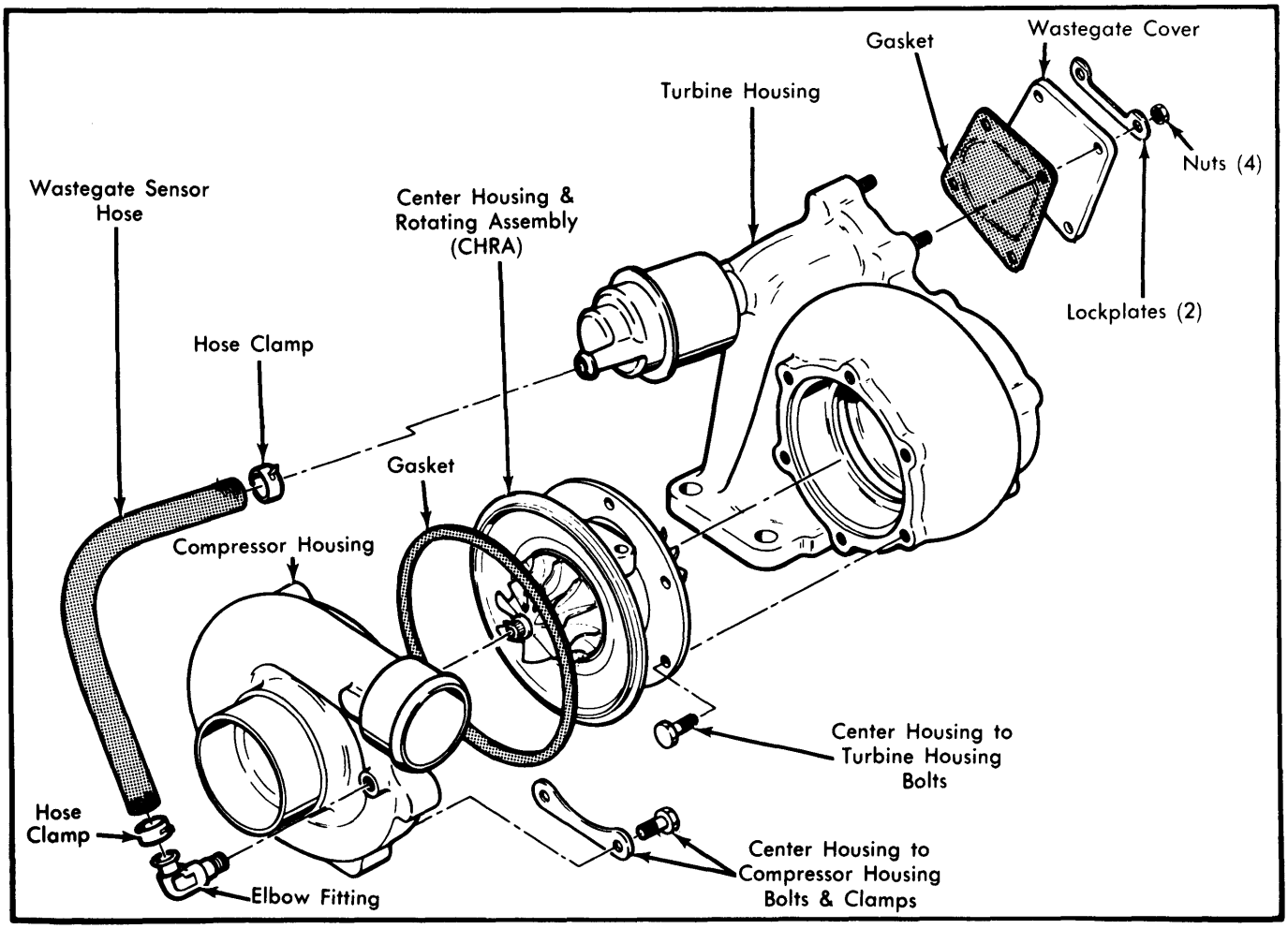


***Fig. 1 Exploded View of Turbocharger Assembly***

## IHC DIESEL TURBOCHARGING SYSTEM (Cont.)

### TESTING

#### WASTEGATE/BOOST PRESSURE TEST

**1)** Remove 1/8" plug (1/8"-28 British Standard Pipe thread) in duct between intake manifold and compressor housing. Install 45° pipe elbow (1/8"-27 NPT female; 1/8"-28 BPT male; IHC Part No. 477 754-C1) to air duct.

**2)** Install a suitable length of tubing to mount boost pressure gauge (SE-2239 or equivalent) in passenger compartment. Road test vehicle. Boost pressure should be between 5.8-7.3 psi with engine under full load at 2400-2800 RPM. *Refer to Road Speed and RPM Chart.*

CAUTION — *Be sure that gauge and tubing are in good condition to prevent any fumes from intake manifold entering passenger compartment during road test.*

**Road Speed and RPM**

| Road Speed (MPH) | Gear Selector | RPM Range |
|---|---|---|
| 56 | 4th | 2450-2800 |
| 40 | ①3rd | 2450-2650 |
| 35 | ②3rd | 2475-2650 |

① — T-428 manual transmission.
② — T-427 manual transmission.

**3)** If boost reading is below specifications, inspect induction system for leaks. If boost pressure is above specifications, perform wastegate inspection and functional check.

### REMOVAL & INSTALLATION

**Removal** — **1)** Remove air cleaner assembly. Loosen clamp and remove air cleaner duct from compressor housing. Remove air intake duct.

**2)** Disconnect turbocharger exhaust outlet pipe from turbine housing. Remove oil feed pipe and return pipe retaining bolts from center housing and rotating assembly (CHRA) and remove both pipes. Remove 4 bolts attaching turbine housing to exhaust manifold and carefully lift off turbocharger assembly.

**Installation** — Install by reversing removal procedure, using new gaskets on turbine housing and oil return pipe.

### INTERNAL INSPECTION

#### COMPRESSOR OIL SEAL

**1)** Remove turbocharger assembly from engine. Disconnect wastegate pressure sensing hose. Scribe a line across compressor housing and CHRA to aid in reassembly.

**2)** Remove 6 compressor housing bolts and lift compressor housing from CHRA. Check for excessive oil on compressor wheel, CHRA and inner housing surface. If excessive oil is detected, replace CHRA.

**3)** Inspect compressor wheel for blade erosion, cracking, damage, rubbing or slipping on shaft. Check for blade rubbing or scrapping in compressor housing. If any of these conditions exist, replace CHRA.

#### TURBINE OIL SEAL

**1)** Remove turbocharger assembly from engine. Disconnect wastegate pressure sensing hose. Scribe a line across turbine housing and CHRA to aid in reassembly.

**2)** Remove 6 turbine housing bolts and lift turbine housing from CHRA. Check for excessive oil on turbine wheel, CHRA, heat shield and inner housing surfaces.

**3)** Inspect turbine wheel for blade erosion, damage, cracking or burning. Check housing for rubbing or scraping and make sure blades and housing passages do not have combustion by-product buildup. If any of these conditions exist, replace CHRA and thoroughly clean housings.

#### SHAFT RADIAL CLEARANCE CHECK

**1)** Remove turbocharger from engine. Attach a suitable dial indicator to center housing so indicator plunger extends through oil outlet port and contacts shaft of turbine wheel assembly. See *Fig. 2.*

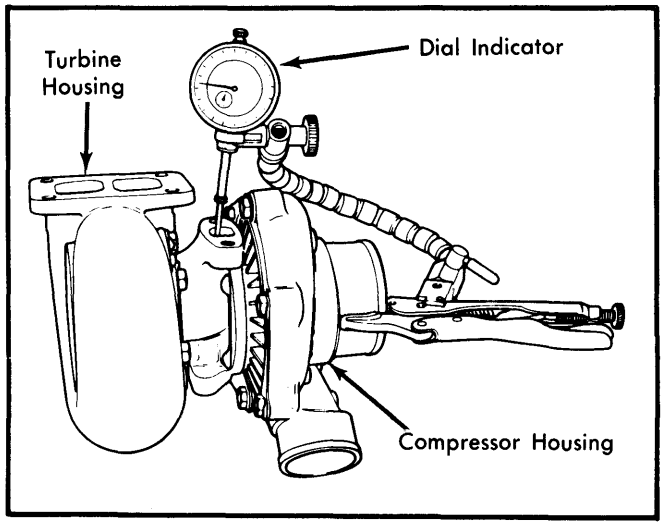


***Fig. 2 Checking Shaft Radial Clearance***

**2)** Manually apply equal pressure to both turbine and compressor wheels to move shaft AWAY from dial indicator plunger. Set dial indicator to ZERO.

**3)** Manually apply equal pressure to both turbine and compressor wheels to move shaft TOWARD dial indicator. Rotate wheels slightly in each direction to make sure shaft has moved as far as it will. Record maximum reading on dial indicator gauge.

**4)** Move both wheels and shaft AWAY from dial indicator. Indicator pointer should be at ZERO. Repeat procedure until maximum reading has been obtained. If maximum reading is not within .003-.006", replace CHRA.

## IHC DIESEL TURBOCHARGING SYSTEM (Cont.)

### SHAFT AXIAL CLEARANCE

**1)** Remove turbocharger from engine. Attach a suitable dial indicator to turbine end of turbocharger so that indicator plunger rests on end of turbine wheel assembly. *See Fig. 3.*

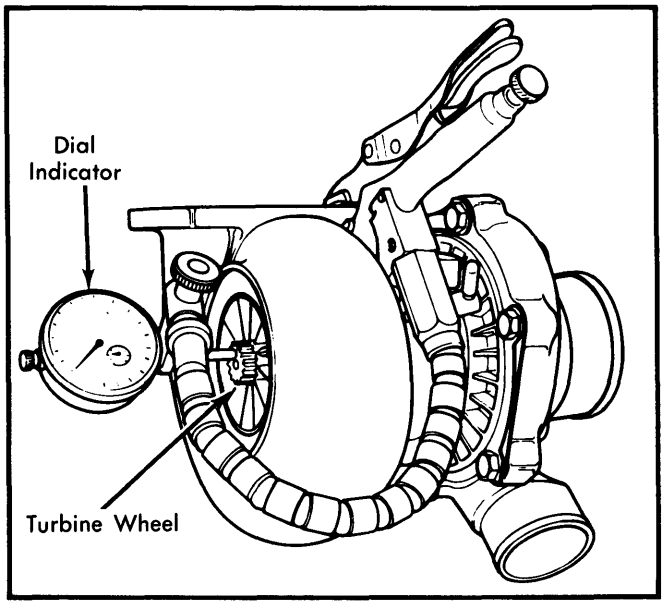


***Fig. 3 Checking Shaft Axial Clearance***

**2)** Manually move the compressor wheel and turbine wheel assembly alternately away from and toward the turbine end of the turbocharger. Note the travel of the shaft shown by the dial indicator.

**3)** Repeat procedure until maximum travel has been indicated. If the maximum thrust bearing clearance is not within .001-.003", replace the CHRA. If turbocharger meets all specifications, remove all test equipment and install to vehicle.

### WASTEGATE FUNCTIONAL CHECK

**1)** Remove wastegate cover bolts, cover and gasket. Install dial indicator so plunger rests against face of wastegate valve. Zero dial indicator. *See Fig. 4.*

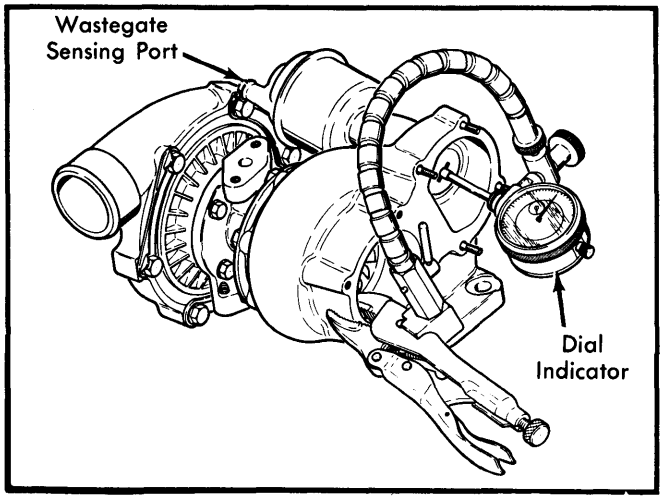


***Fig. 4 Wastegate Functional Check***

**2)** Remove wastegate pressure sensor hose and install hand operated vacuum/pressure pump to wastegate sensing port. While lightly tapping turbine housing, apply 8.32-8.89 psi air pressure. Note valve movement shown on dial indicator and release pressure.

**3)** Repeat several times to make sure wastegate movement has been accurately measured. If valve moves less than .050", replace turbine housing assembly. Install new gasket and reinstall cover.

## OVERHAUL

### DISASSEMBLY

**1)** Remove turbocharger from engine. Clean exterior surfaces of turbocharger in mild solvent. DO NOT soak or spray solvent directly into turbine housing or compressor housing. This will wash lubrication from shaft bearing, causing turbocharger failure.

**2)** Remove wastegate sensor hose and clamps. Remove wastegate valve cover and gaskets. Scribe a line from turbine housing to center housing for orientation during reassembly. Remove 6 bolts attaching turbine housing to centerhousing and lift turbine housing off centerhousing.

**3)** Scribe a line from compressor housing to center housing for orientation during reassembly. Remove 6 bolts attaching compressor housing to center housing. Remove compressor housing from center housing.

NOTE – *The center housing rotating assembly (CHRA), turbine housing and wastegate and the compressor housing are the 3 main assemblies of the turbocharger. Further disassembly is unnecessary since parts for these are not serviced. If any part of the CHRA is defective, it must be replaced as a unit. This applies to the compressor housing and the turbine housing/wastegate valve assembly.*

### REASSEMBLY

NOTE – *When reassembling, it is necessary to replace all nuts, bolts, gaskets, lockplates and wastegate sensor hose. Coat all threads of bolts and studs with a high temperature anti-seize compound.*

Reassemble in reverse order of disassembly making sure scribe marks align properly. If new CHRA is being installed, temporarily mount assembled turbocharger to engine and make sure oil feed and return lines will mount properly.

### TIGHTENING SPECIFICATIONS

| Application | INCH Lbs. |
|---|---|
| Compressor Housing Bolts | 145-165 |
| Turbine Housing Bolts | 164-181 |
| Wastegate Cover Bolts | 80-100 |